sus monkeys, according to Mary Lou Ballweg, cofounder and president of the Endometriosis Association. The original study, which was begun in 1977 and involved 24 rhesus monkeys randomly assigned to a diet containing 5 parts per trillion (ppt) dioxin (low dose), 25 ppt (high dose), or no dioxin over a 4-year period, examined only reproductive and neonatal impact.

It was years after the dioxin diet had been discontinued and autopsies implicated severe endometriosis in the deaths of several of the monkeys, a finding that reached Ballweg by word-of-mouth, that the Endometriosis Association stepped in, just in time to prevent the dispersal of the monkey colony to the highest bidders. The association brought in two of its expert advisors, one of whom coauthored the *Fundamental and Applied Toxicology* study, to perform a daylong laparoscopy examination on the survivors. The scopes were blinded, and the results were astounding," Ballweg says.

Meanwhile, the colony is dwindling as more animals die, and the survivors will reach menopause within three years. The Endometriosis Association is mobilizing to fund as many studies as possible in the remaining time, with a particular interest in exploring dioxin-related immunological alterations. "Endometriosis may be more an immunologic disorder with reproductive consequences, rather than the other way around," Ballweg suspects.

"The sad fact," says Rier, who is conducting immunologic studies, "is that the best time to have done these studies would have been from the time of exposure over the years the disease was developing, so that changes in immune function and disease progression could have been observed side by side. At this point, we can't tell cause from effect—if the immune changes arise from the dioxin exposure or from the disease."

Linda Birnbaum, director of the environmental toxicology division of the EPA's health effects research lab, concurs: "We do know that dioxin alters the immune system of rhesus monkeys, but 10 years postexposure it's hard to sort out the composite effects. It's highly likely though." Birnbaum adds, "These chemicals are associated with an increased risk of endometriosis. This is a very relevant study."

Rier's preliminary studies reveal disease-related differences in markers of immune dysfunction such as immune cell cytokine production, increases in tumor necrosis factor, and decreases in interleukin-6. Rier is also examining natural killer cell activity and antiphospholipid antibodies in ongoing studies.

In the randomized rhesus study, as well as in the general rhesus population at the primate center, the spontaneous endometriosis rate was about 30%, considerably higher than the apparent rate among women. Even so, the findings in these animals were "minimal," Rier observes, compared to the severe and symptomatic manifestations in 79% of the dioxin-exposed monkeys. Moreover, Rier and others note, the incidence of mild, asymptomatic endometriosis among women is not known.

The results of this study have prompted a joint effort by NIEHS, CDC, and Duke University investigators to compare the blood levels of dioxin and related compounds in 30 women with and without endometriosis. A larger, more definitive study will be undertaken if higher levels of dioxin are found among endometriosis patients than controls, says George Lucier, chief of the NIEHS Laboratory of Biochemical Risk Analysis. The results of the preliminary study—the first to explore in humans the hitherto unsuspected link between dioxin and endometriosis—are expected by the end of the year. Even if rhesus monkeys are actually more susceptible to endometriosis than are women, "the dose–response relationship and the severity of disease give the rhesus dioxin findings more power," Lucier comments, noting that dioxin's actions both as a potent environmental hormone and an immunotoxin provide two plausible mechanisms for a role in endometriosis induction.

Meeting for Justice

An upcoming symposium in the nation's capital will bring together community leaders, government health agency representatives, and members of academia with the goal of developing research strategies to eliminate environmental health injustice in the United States. Environmental justice includes issues such as race, socioeconomic class, occupation, differential exposure, and proximity of housing to environmental hazards, all of which may directly affect a person's health.

NIEHS, EPA, the Agency for Toxic Substances and Diseases Registry, the National Institute of Occupational Safety and Health, the Department of Energy, and the NIH Office of Minority Research are co-sponsoring a symposium entitled "Health Research and Needs to Ensure Environmental Justice," to be held 10–12 February 1994. Participants will meet for three days in an interactive environment to:

- identify at-risk populations and research gaps;
- acquire information to develop a comprehensive, long-term intra- and interagency research agenda (with projected funding) that incorporates community needs and priorities of at-risk populations.
- design a prevention and intervention model as part of a larger research, education, training, and community outreach (multilingual, multicultural, multiracial, and multiethnic) effort;
- facilitate public input and participation, especially from underrepresented communities, to address problems, design research plans, collect data, and implement plans;
- develop mechanisms to diversify the pool of health science professionals to include experts from affected and underrepresented communities trained in environmental health fields as scientific advisors and peer review panelists on research studies and health research grants; and
- make recommendations on interagency cooperation related to research needs of at-risk populations and target resources that build on strengths of existing agency mandates and directives.

"This symposium was planned with the participation of community leaders and concerned citizens working as full partners," notes Dan VanderMeer, director of the NIEHS Office of Planning and Evaluation. "We see this as an exciting opportunity to expand and accelerate federal efforts to improve environmental health in urban and rural areas through the involvement of underrepresented persons in development of strategies that recognize community needs."

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Biomarkers of Genetic Susceptibility

The Human Genome Project